CLAIMS

1. An image processing device, comprising:

recursive filtering means of smoothing an input image; and

arithmetic means of subtracting an input image smoothed by the recursive filtering

5 means from the original of the input image,

wherein the recursive filtering means includes:

edge setting means of setting at least one edge having a predetermined angle

from a scanning line direction of the input image; and

control means of smoothing the image to be smoothed in correspondence with

10 the edge set by the edge setting means.

2. The image processing device according to claim 1, further comprising:

display means of displaying the input image; and

region of interest setting means of setting a region of interest in the input image

displayed in the display means,

15 wherein the edge setting means sets the edge on the basis of the region of interest

set by the region of interest setting means.

3. The image processing device according to claim 1, further comprising

low-frequency component compression means of setting an amount of compression by

which low-frequency components of the input image are compressed according to the

20 smoothed image generated by the recursive filtering means,

wherein the control means changes an output from the recursive filtering means

on the basis of the compression amount set by the low-frequency component

compression means.

4. The image processing device according to claim 3, wherein the low-frequency

25 component compression means has lookup table means supplied with an output value

from the recursive filtering means and converting the output value into a value obtained

by multiplying the output value by a predetermined coefficient.

5.   The image processing device according to claim 4, wherein the lookup table means changes the predetermined coefficient according to a catheter displayed in the input image.

6.   The image processing device according to claim 1, wherein the recursive filtering means performs processing expressed by

$$g(t) = k \cdot f(t) + (1 - k) \cdot g(t - 1)$$

where g(t) is the output from the recursive filtering means, k is a filter coefficient, f(t) is the input image, 1 - k is a feedback rate, and g(t - 1) is the output from the recursive filtering means one-line before, and

changes the feedback rate (1-k) on the basis of the magnitude of the difference (d) between the input image (f(t)) and the output value (g(t - 1)) of the recursive filtering means one-line before.

7.   The image processing device according to claim 1, wherein the recursive filtering means separately generate smoothed images with respect to edges in direction at 45° from the scanning line direction of the input image (left-downward direction), a direction at 90° from the scanning line direction (downward direction) and a direction at 135° from the scanning line direction (right-downward direction).

8.   The image processing device according to claim 7, wherein weighting averaging is performed on the smoothed images separately generated with respect to the edges by the recursive filtering means.

9.   The image processing device according to claim 1, wherein the recursive filtering means generates the smoothed image by selecting the edge according to the direction in which a catheter displayed in the input image travels.

10.   The image processing device according to claim 1, further comprising delay means of delaying the input image with respect to time processings performed by the processing means including the recursive filtering means,

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wherein the input image delayed by the delay means is input as the original of the image input to the arithmetic means.

11. The image processing device according to claim 1, wherein the recursive filtering means comprises:

5   a first line memory in which one line of the input image is stored;

a second line memory in which line data before storage in the first line memory is stored;

an arithmetic device which subtracts the line data stored in the first line memory from the line data stored in the second line memory;

10   lookup table means of converting the difference value obtained by subtraction performed by the arithmetic device into a value obtained by multiplying the difference value by a filter coefficient; and

an adder which adds together the value converted by the lookup table means as a result of multiplication by the filter coefficient and the line data stored in the second line

15   memory.